In Situ Observation on Hierarchical Actin Bundle Networks(Poster session 1, New Frontiers in Colloidal Physics : A Bridge between Micro- and Macroscopic Concepts in Soft Matter)

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In Situ Observation on Hierarchical Actin Bundle Networks

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アメーバ運動は、生体内の細胞骨格タンパク質であるアクチンがアクチン結合タンパク質を介して形成するバンドル、二次元ネットワーク、三次元ゲル構造の構築と消滅の制御によって生み出されている。本研究では、アクチン結合タンパク質のモデルとしてポリカチオンを用い、フィラメントアクチンとポリカチオンが形成する複合体構造を中性子超小角散乱法を用いて観察した。その結果、ポリカチオン濃度の増大によるバンドル内のフィラメント密度の増大、および、塩濃度の増加によるバンドル構造の消滅を明らかにした。

Actin is one of the most abundant cytoskeleton proteins in eucaryotic cell. They play a crucial role in cell motility by polymerizing monomeric globular G-actin into polymeric filamentous actin (F-actin). With actin-binding proteins (ABPs), they form higher order structures such as linear bundles, two-dimensional networks and three-dimensional gels. It has been considered that these structures are controlled by ABPs. However recent study have shown that the only one kind of artificial cationic polymer can form variety of structures depending its concentration and salt concentration. [1] This system is a good model to elucidate the mechanism of regulation of actin and ABPs complex structure. Based on these backgrounds, we have investigated the effects of salt concentration on the stability and structure of actin-polycation complexes by using small angle neutron scattering (SANS) technique.

The actin was extracted from adductor muscle of scallops by the method of Spudich and as a model of ABPs we used artificial cationic polymer PDMAPAA-Q. In Fig.1 we show SANS profiles from the actin and PDMAPAA-Q complexes for various KCl concentration, where the concentration of actin and polymer are kept constant. At low concentration of KCl, F-actin forms bundle structures as shown by one distinct peak at $q = 0.08$ Å ^{1}. The increase of KCl brings the peak position to lower q and sharpens its peak. By the further addition of KCl, the SANS profiles changed dramatically at KCl = 0.35M, which indicates that the bundle structure disassemble to the native filamentous actin. From the first peak we estimated the distance

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between F-actin inside the bundle d, peak width which is the measure of the orderliness of the actin alignment w and the slope from low q region as a function of KCl concentration (Fig.2). Our result shows that the slight fluctuation of salt concentration brings dramatic change of the complex structures, which is important to regulate the motility of cell.

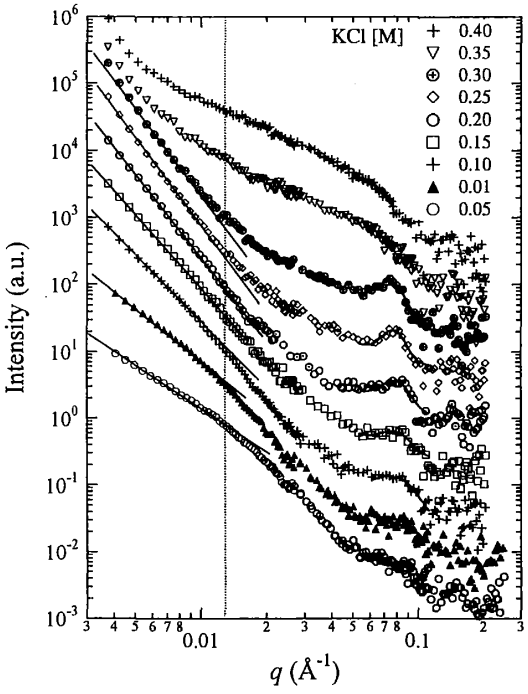

Figure 1: SANS profiles from actin and PDMAPAA-Q complexes for various KCl concentration.

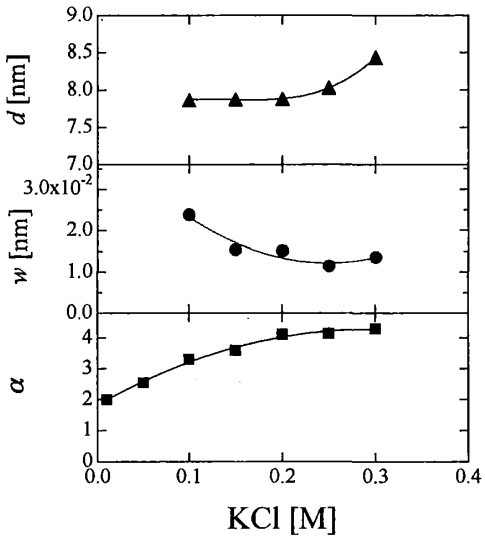

Figure 2: Distance between actins inside the bundles d and width of the first peak w and slope of the scattering profiles as a function of KCl concentration.

References

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